

## CLAIMS

1. A method for producing a mesostructured film  
film comprising the steps of:

- preparing a reaction solution containing a  
5 precursor material for mesostructured film which  
contains a metal oxide, and an amphiphilic material;  
applying the reaction solution onto a substrate  
having a capability of orienting an aggregate of the  
amphiphilic material in a predetermined direction;  
10 and

forming the mesostructured film having a  
plurality of the aggregates of the amphiphilic  
material oriented in the predetermined direction  
while holding the substrate onto which the reaction  
15 solution has been applied in a vapor-containing  
atmosphere.

2. A method for producing a mesostructured film  
according to claim 1, wherein the precursor material  
20 contains tin.

3. A method for producing a mesostructured film  
according to claim 1, wherein the precursor material  
is a metal chloride.  
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4. A method for producing a mesostructured film  
according to claim 1, wherein the amphiphilic

material is a surfactant.

5. A method for producing a mesostructured film according to claim 1, wherein the step of forming the mesostructured film having a plurality of aggregates of the amphiphilic material oriented in the predetermined direction is performed at a temperature of 100°C or less.

10 6. A method for producing a mesostructured film according to claim 1, wherein the step of forming the mesostructured film having a plurality of aggregates of the amphiphilic material oriented in the predetermined direction is performed at a relative humidity in a range of from 40% to 100%.

7. A porous film on a substrate, comprising a plurality of tube-shaped pores oriented in a predetermined direction and containing a metal oxide in a pore wall of the porous film.

8. A porous film according to claim 7, the porous film comprising tin oxide in the pore wall.

25 9. A porous film according to claim 7, wherein the tube-shaped pores are mesopores each having a pore diameter of from 2 nm to 50 nm.

10. A porous film according to claim 7, wherein the pores hold an aggregate of an amphiphilic material.

5 11. A porous film according to claim 7, wherein at least 60% of the tube-shaped pores are oriented within a range of  $-40^{\circ}$  to  $+40^{\circ}$  in an orientation direction distribution as measured by an in-plane X-ray diffraction analysis.

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12. A porous film according to claim 7, wherein the substrate has a capability of orienting the aggregate of the amphiphilic material in the predetermined direction.

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13. A porous film according to claim 12, wherein the substrate having the capability of orienting the aggregate of the amphiphilic material in the predetermined direction is a substrate on the surface of which a polymer compound film provided with anisotropy has been formed.

14. A porous film according to claim 12, wherein the substrate having the capability of orienting the aggregate of the amphiphilic material in the predetermined direction is a monocrystal substrate having such an orientation that an atomic

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arrangement at a surface of the substrate has two-fold symmetry.

15 15. A porous film according to claim 14,  
wherein the monocrystal substrate is of the (110)  
surface of silicon monocrystal.

16. A porous film according to claim 12,  
wherein the substrate having the capability of  
10 orienting the aggregate of the amphiphilic material  
in the predetermined direction is a substrate on the  
surface of which a polymer compound film provided  
with anisotropy or a Langmuir-Blodgett film of a  
polymer compound has been formed.

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17. A method for producing a porous film  
comprising the steps of:

preparing a reaction solution containing a  
precursor material for a porous material which  
20 contains a metal oxide, and an amphiphilic material;  
applying the reaction solution onto a substrate  
having a capability of orienting an aggregate of the  
amphiphilic material in a predetermined direction;  
forming the porous material having a plurality  
25 of the aggregates of the amphiphilic material  
oriented in the predetermined direction while holding  
the substrate onto which the reaction solution has

been applied in a vapor-containing atmosphere; and  
removing the amphiphilic material to form a  
pore.